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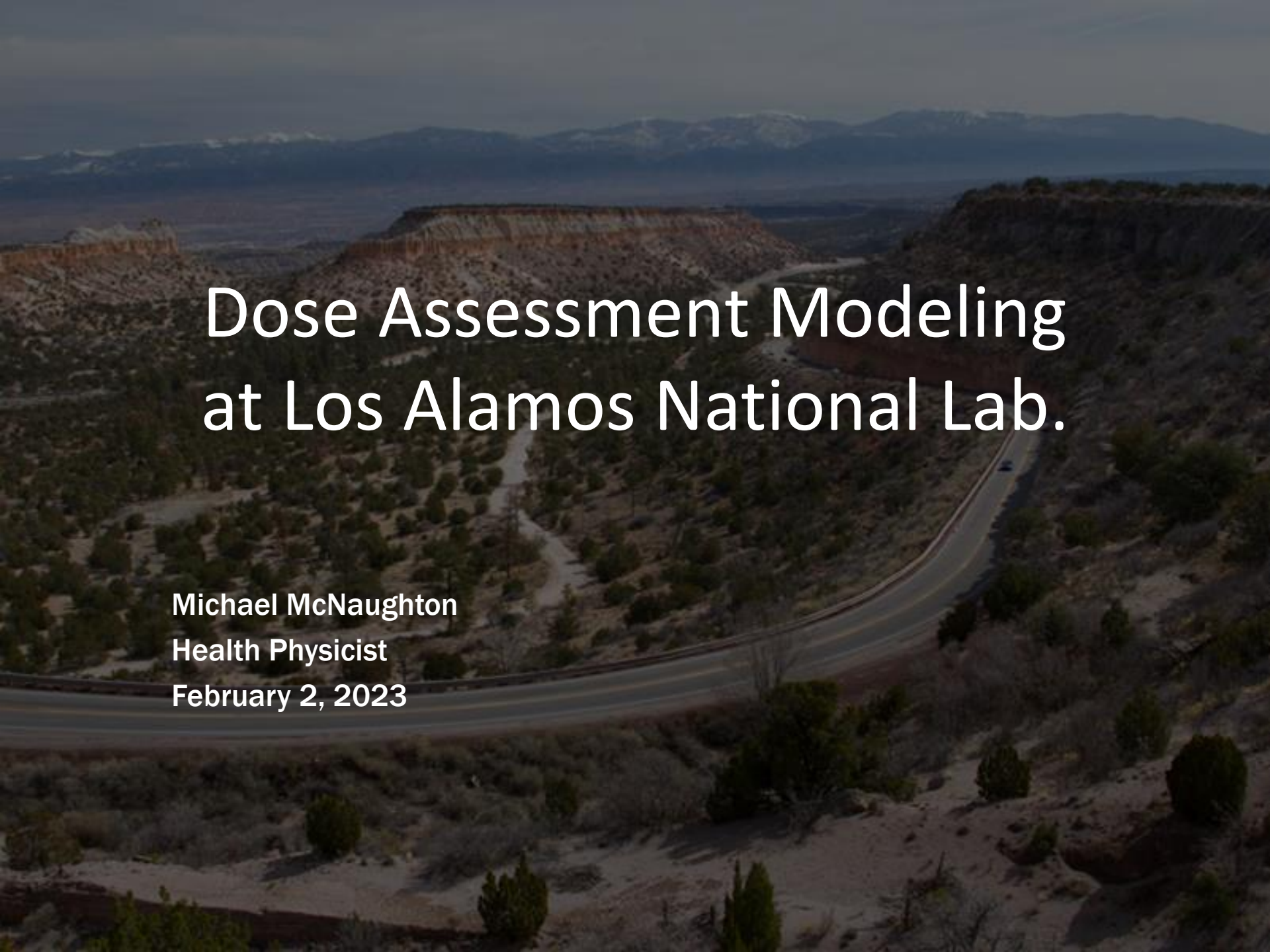
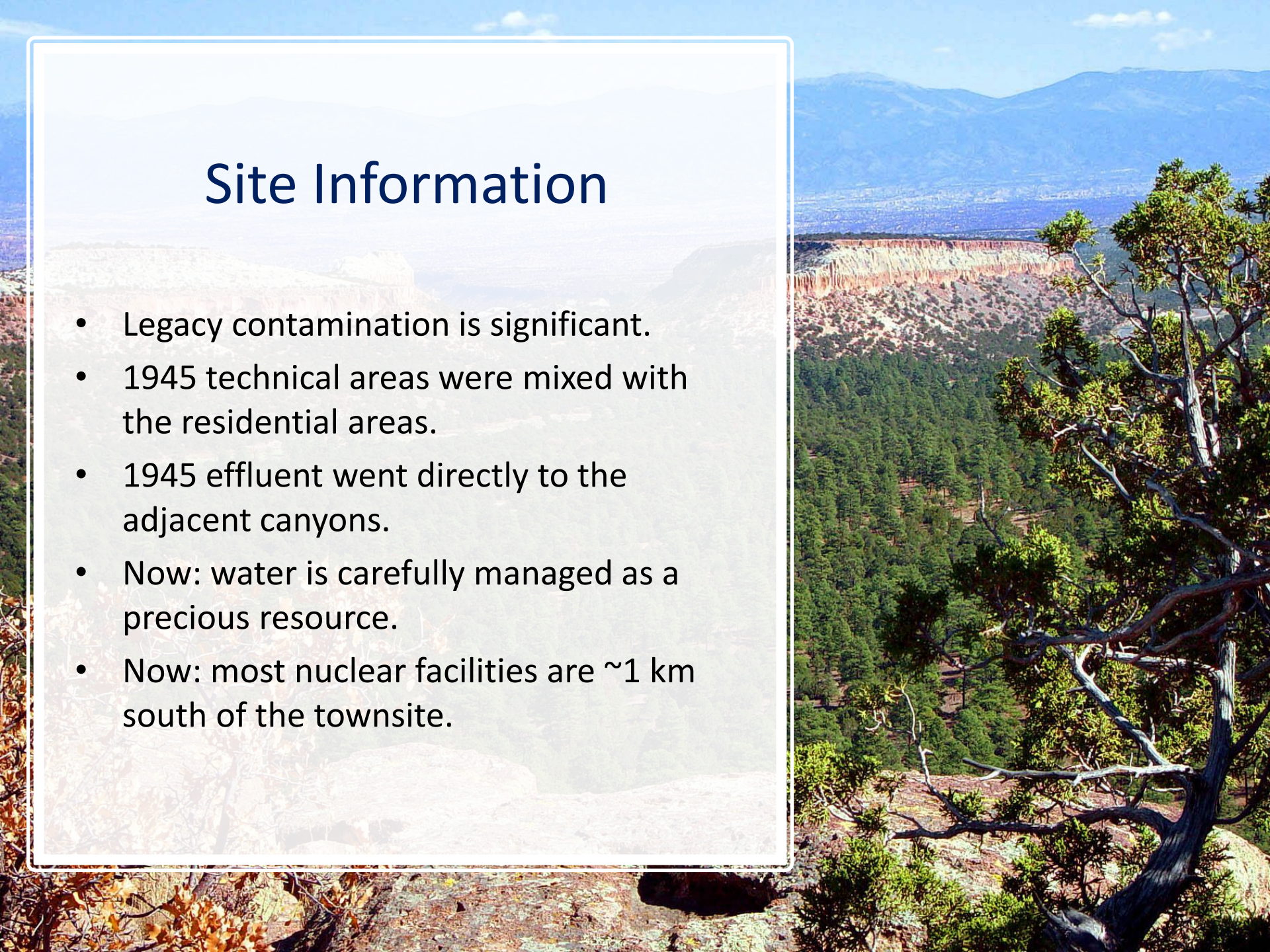


Dose Assessment Modeling at Los Alamos National Lab.

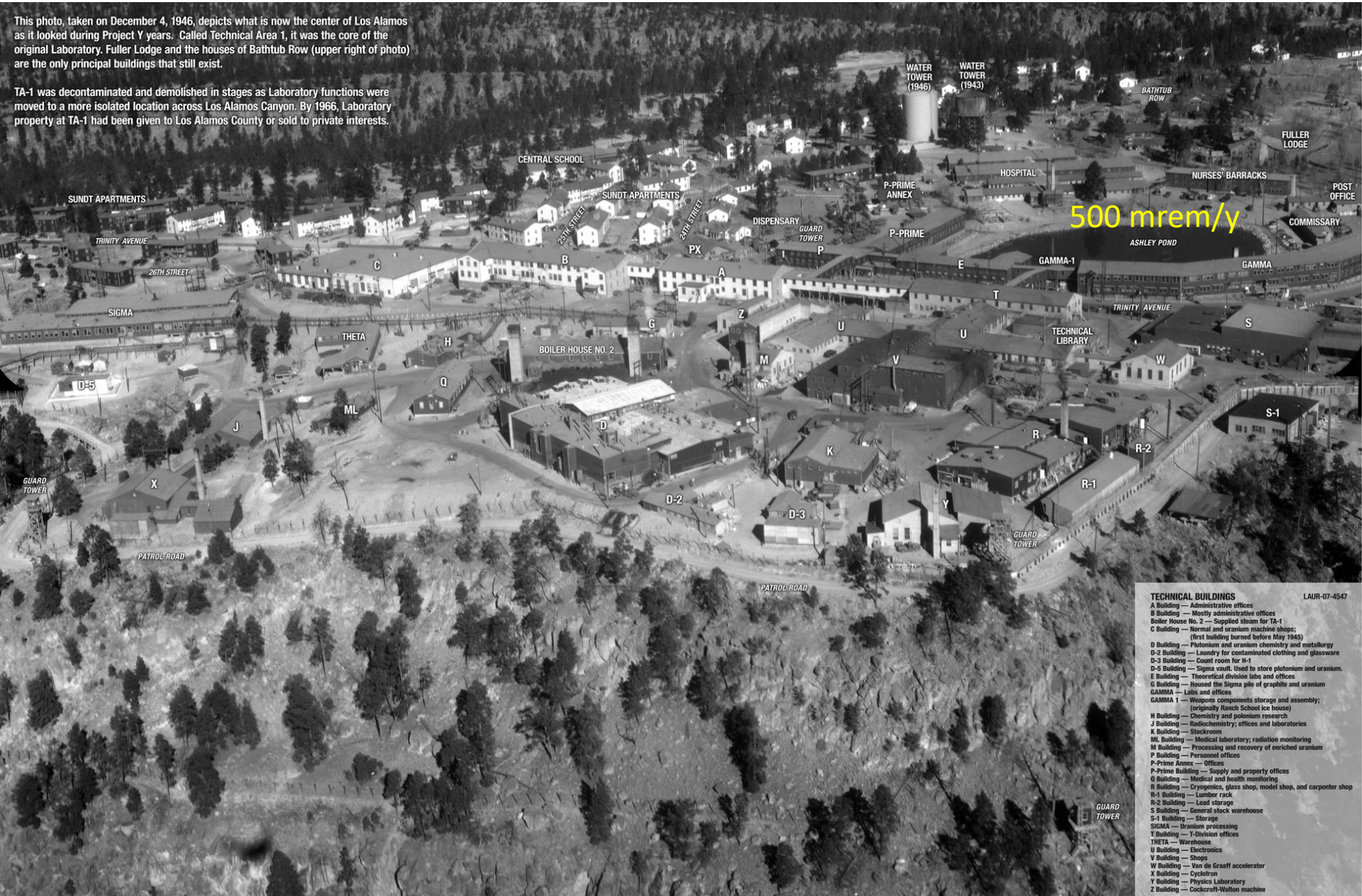
Michael McNaughton
Health Physicist
February 2, 2023

Site Information

- Legacy contamination is significant.
- 1945 technical areas were mixed with the residential areas.
- 1945 effluent went directly to the adjacent canyons.
- Now: water is carefully managed as a precious resource.
- Now: most nuclear facilities are ~1 km south of the townsite.

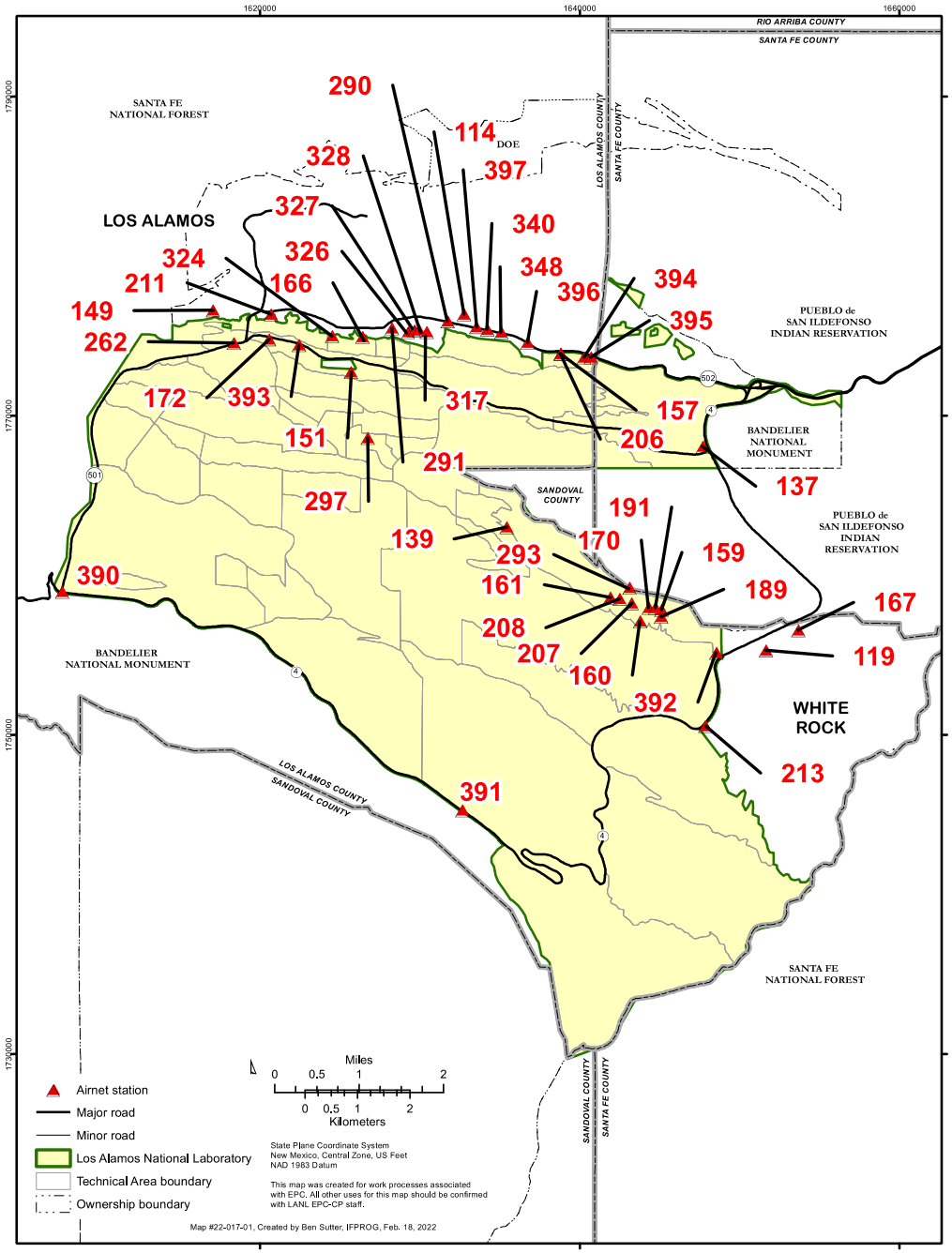


1945 MEI ~500 mrem; 2021 MEI = 0.5 mrem



Site Information

- Accelerator facility emits ^{11}C, ^{13}N, ^{15}O.
- Isotope production facility emits activation products.
- Tritium facility is >5 km from residential areas.
- Plutonium and uranium emissions are small.



Air Sampling

- 20 air-sampling stations are along the southern edge of the townsite.
- The MEI locations are near these stations.
- 8 air-monitoring stations are near the Pueblo de San Ildefonso Indian Reservation.

Requirements or Guidance

At LANL, we often refer to the following.

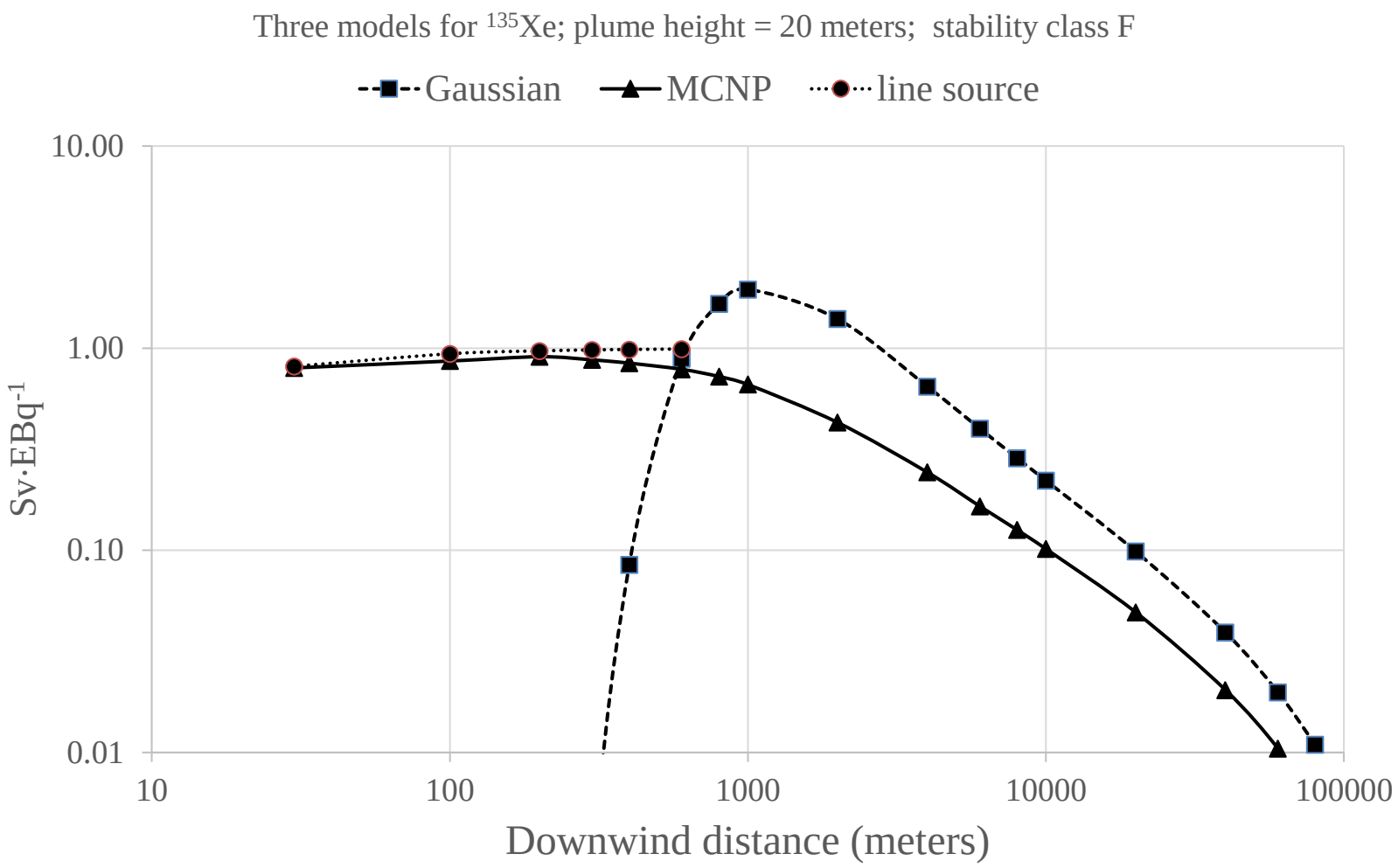
- DOE Order 458.1
- 40 CFR 61 Subpart H (Air)
- 40 CFR 141 (Water)
- DOE-STD-1196-2021 (Dose Conversion Factors)
- EPA Exposure Factors Handbook

Radiation Modeling

- CAP88 is used for point sources and diffuse sources.
- 40 CFR 61 App. E is used for ambient air at the receptors.
- Direct radiation is measured near the source and near the receptor. MCNP calculates the dose.
- MCNP also calculates neutron energy spectra.
- RESRAD and hand calculations are used for ingestion.
- If <0.1 mrem/y, we use simple and conservative methods.
- We use annual sampling data for input. In 2022, there were ~1 million new database records.
- CAP88 is not accurate for external radiation from airborne radioactive material, as shown in the following slides.

CAP88 uses a Gaussian plume model for external radiation.

It usually underestimates near the source and overestimates far from the source.



Maximally Exposed Individual

- We calculate the dose at >30 locations; the largest is the MEI.

Major pathways are as follows.

- Inhalation dose is calculated by CAP88.
- Inhalation dose is also measured by ambient air samplers.
- External radiation from airborne material is calculated by CAP88.
- Direct radiation is measured near the source and calculated by MCNP.
- Other pathways contribute <0.1 mrem/year.
- radionuclides in food and drinking water are indistinguishable from background.

Site Specific Background

- Criterion: “Indistinguishable From Background”.
- → It is important to define the background!
- Soil background depends on geology.
- Building material background depends on its origin.
- Global fallout depends on rainfall, snowfall, and surface runoff.
- Wildfires increase surface concentrations.
- Vegetation-to-soil concentration ratios are variable.
- → It is challenging to define the background!

Thank you for listening.

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